Stoller
Hanford Office

DOE-EM/GJ653-2004

299-E25-4 (A4788)
Log Data Report

Borehole Information:

Borehole: 299-E25-4 (A4788)			**Site:** 216-A-8 Crib		
Coordinates (WA State Plane)		**GWL (ft)[1]:**	Not deep enough	**GWL Date:**	4/05/2004
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
136,169.12 m	575,648.83 m	April 1956	202.722 m	291	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	+2.20	6 5/8	6	5/16	+2.20	233
Welded steel	0	8	unknown	unknown		289
The logging engineer measured the casing stickup using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. Casing thickness was calculated. There is no evidence of 8-in. casing at the ground surface as reported in Ledgerwood (1993).						

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS[3], and Ledgerwood (1993). Zero reference is the top of the 6-in. casing.

Logging Equipment Information:

Logging System:	Gamma 1G		**Type:**	35% HPGe (34TP10967A)
Calibration Date:	01/2004	**Calibration Reference:**	GJO-2004-597-TAC	
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 / Repeat	
Date	4/05/03	4/05/03	4/05/03	4/05/03	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	70.0	265.0	171.0	35.0	
Finish Depth (ft)	3.0	170.0	69.0	8.0	
Count Time (sec)	200	200	200	200	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	N/A[4]	N/A	N/A	N/A	
Pre-Verification	AG063CAB	AG064CAB	AG065CAB	AG066CAB	

Log Run	1	2	3	4 / Repeat	
Start File	AG063000	AG064000	AG065000	AG066000	
Finish File	AG063067	AG064095	AG065102	AG066027	
Post-Verification	AG063CAA	AG064CAA	AG065CAA	AG066CAA	
Depth Return Error (in.)	-1	0	-1	0	
Comments	No fine-gain adjustment.	Fine-gain adjustment after files -059 and -089.	Fine-gain adjustment after files -059 and -088.	Repeat section.	

Logging Operation Notes:

Zero reference was top of the 6-in. casing. Logging was performed without the centralizer on the sonde for spectral data collected between 265 and 170 ft. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118.

Analysis Notes:

Analyst:	Sobczyk	Date:	04/16/04	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. All of the post-run verification spectra were within the acceptance criteria. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 3.4 percent lower and 5.7 percent higher at the end of the day.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1GJan04.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 6-in. casing. Based on Ledgerwood (1993), the casing configuration was assumed to be a string of 6-in. casing with a thickness of 5/16 in. to a log depth of 233 ft and a string of 8-in. casing with a thickness of 0.322 in. to total logging depth (265 ft). The 6-in. casing thickness was measured by the logging engineer. A casing thicknesss of 0.322 in. was assumed for the 8-in. casing. This thickness is the published value for ASTM schedule-40 steel pipe, a commonly used casing material at Hanford. Where more than one casing exists at a depth, the casing correction is additive (e.g., the correction for both 6-in. and 8-in. casing would be 0.313 + 0.322 = 0.635). A water correction was not required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. In addition, a comparison log plot of ^{137}Cs is provided to compare the data collected in 1990 and 1995 by Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected in two intervals. ^{137}Cs was detected from near the ground surface to a log depth of 30 ft. The range of concentrations was from the MDL (0.3 pCi/g) to 13.1 pCi/g; the maximum concentration was measured at 26 ft. ^{137}Cs was detected at log depths between 227 and 247 ft. The range of concentrations was from near the MDL to 1.4 pCi/g, which was measured at 233 ft. ^{137}Cs was also detected at 165 and 264 ft at concentrations near the MDL. The well construction summary (Ledgerwood 1993) shows 6-in. casing to 233 ft, with grout to 225 ft. The presence of grout in the annular space between the two casing strings is not accounted for, and likely contributes to underestimation of radionuclides above 225 ft. Spectral data below 225 ft are believed to more accurately represent the contaminated profile.

The concentrations of the KUT and man-made radionuclides above 225 ft are under estimated due to effects of grout. The total gamma increases by 50 cps, ^{40}K increases by 5 pCi/g and ^{232}Th increases by 0.3 pCi/g at 86 ft. The total gamma decreases by 40 cps and ^{40}K decreases by 5 pCi/g at 180 ft.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides (609, 1461, 1764, and 2614 keV) and ^{137}Cs.

Gross gamma logs from Additon et al. (1977) (attached) indicate that the sediments surrounding this borehole contained significant amounts of man-made gamma radiation from 1958 through at least 1976. The logs from 1958 and 1959 indicate high levels of gamma-emitting contamination at or near groundwater. The logs from 2/19/58 and 6/1/59 appear to detect relatively high gamma activity in the intervals from 6 ft (2 m) to 131 ft (40 m), 187 ft (57 m) to 197 ft (60 m). and below 233 ft (71 m). The log from 5/14/63 appears to detect relatively high gamma activity in the interval from 10 ft (3 m) to 131 ft (40 m). The log from 2/20/76 appears to detect relatively high gamma activity in the interval from 10 ft (3 m) to 26 ft (8 m). Comparison of these gross gamma logs indicates that a contamination event occurred prior 1958, which was followed by another event after 1959 and before 1963. The SGLS detected ^{137}Cs in only two of the intervals (3 to 30 ft and 227 to 247 ft), which had elevated gamma in the late 1950s. Man-made radionuclides were not detected in the interval from 187 to 197 ft with the SGLS.

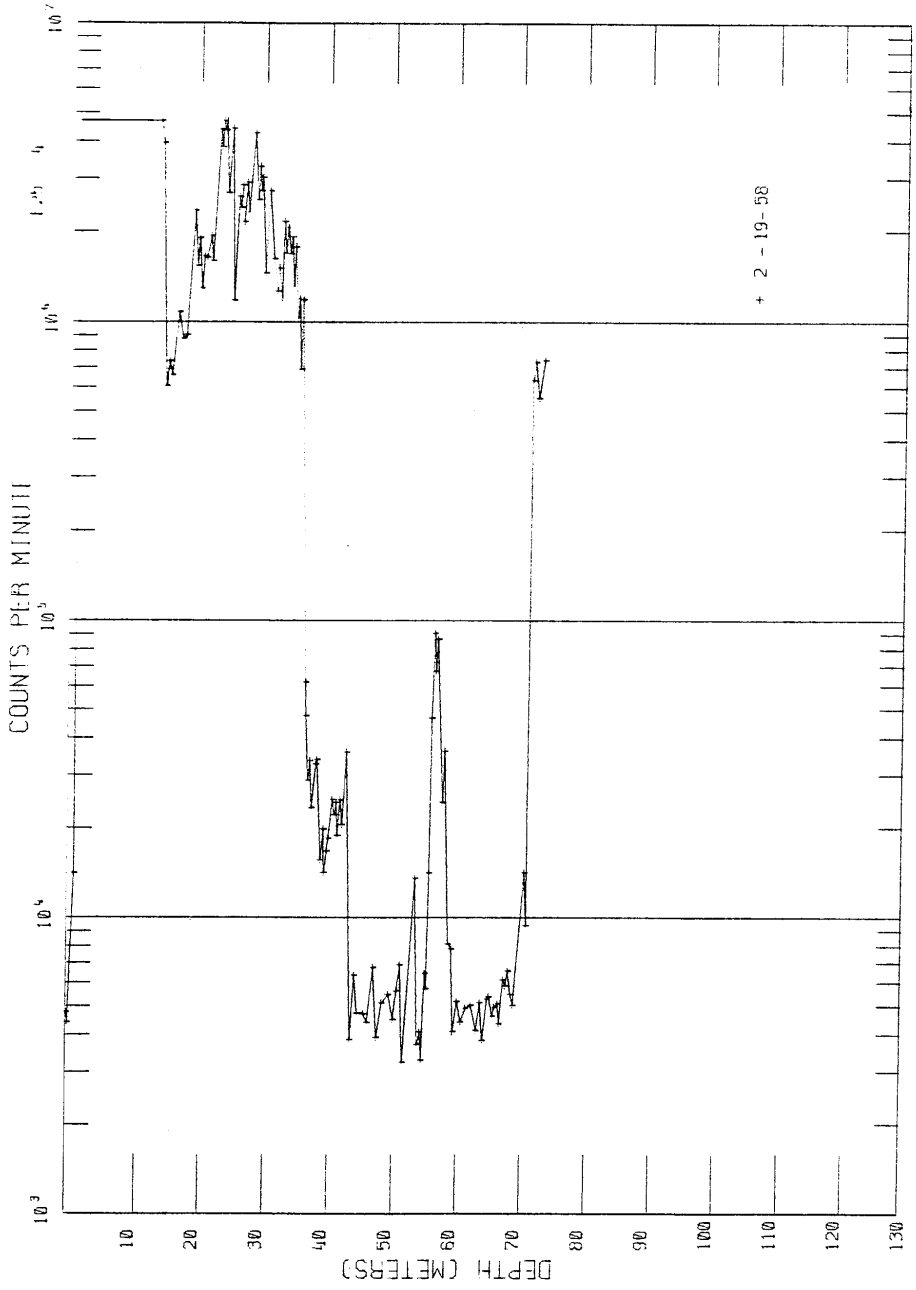
A comparison log plot of ^{137}Cs data collected in 1990 and 1995 by Westinghouse Hanford Company (WHC) and in 2004 by Stoller is included. The WHC concentration data for ^{137}Cs are decayed to the date of the SGLS logging event in April 2004. No data were collected below 120 ft in the 1990 RLS log run. The SGLS and 1990 RLS log appear to use a slightly different depth reference. Because both the 1990 and 1995 data are corrected for only one string of casing (0.33 in. and 0.26 in., respectively), the ^{137}Cs concentrations based on the SGLS data were recalculated for this comparison using a casing thickness of 0.26 in. Assuming a thinner casing yields lower concentration values. Taking into account the differences in depth registration, the modified ^{137}Cs concentrations show good agreement between the logging systems. Since 1990, ^{137}Cs activities have decreased as predicted by radioactive decay.

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Well*s, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

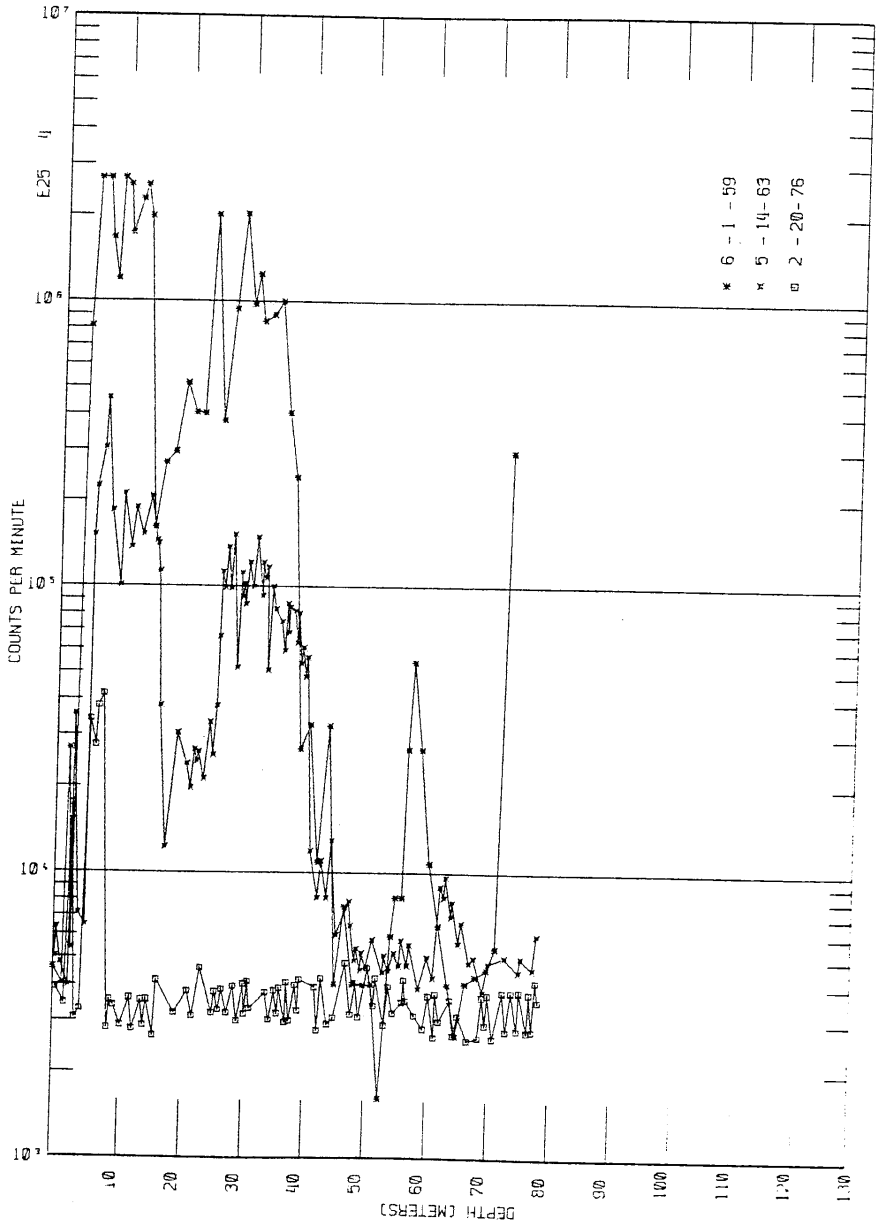
Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] N/A – not applicable



from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E25-4, Logged on 2/19/58



from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E25-4, Logged on 6/1/59, 5/14/63, and 2/20/76

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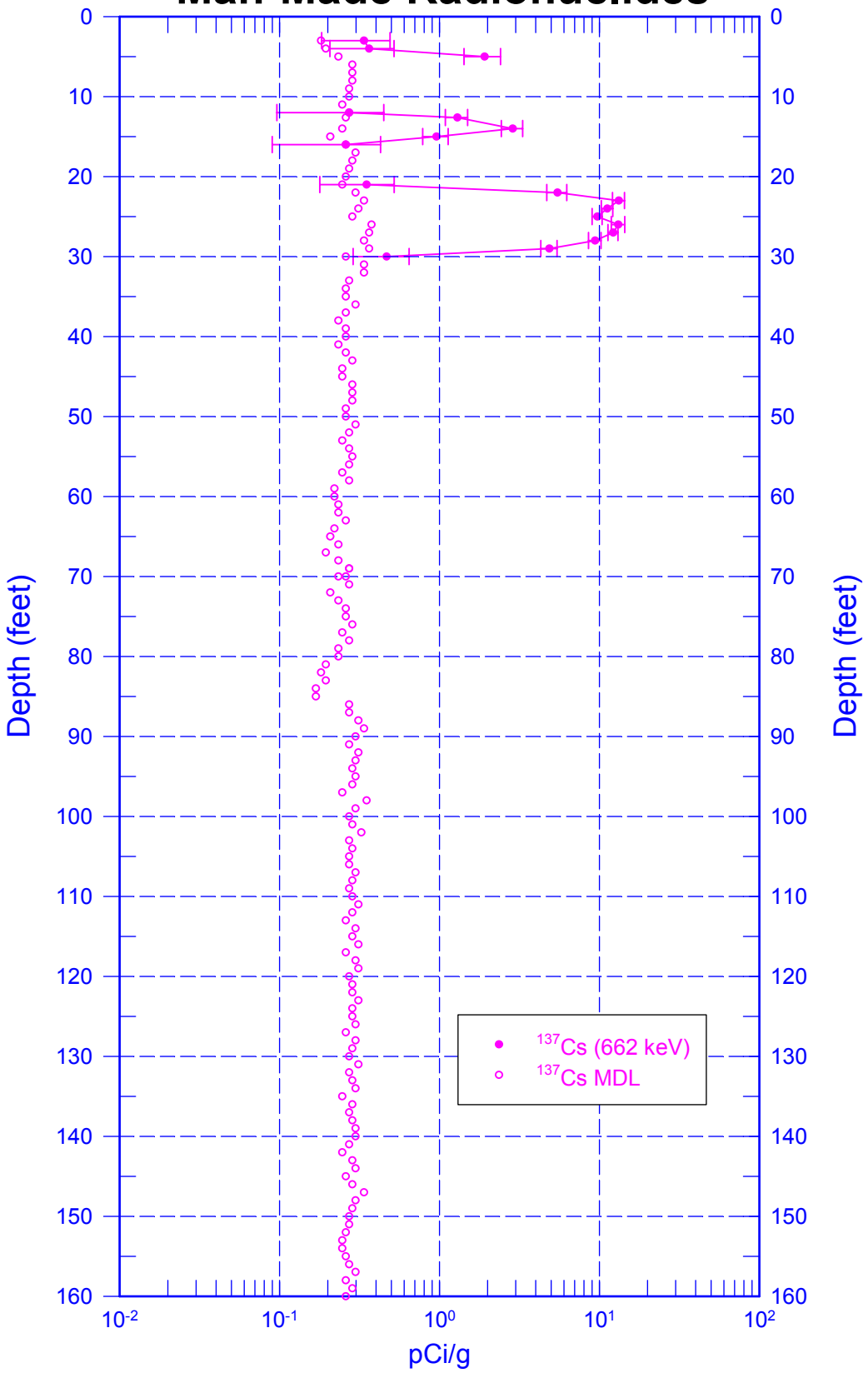
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
4/08/2004

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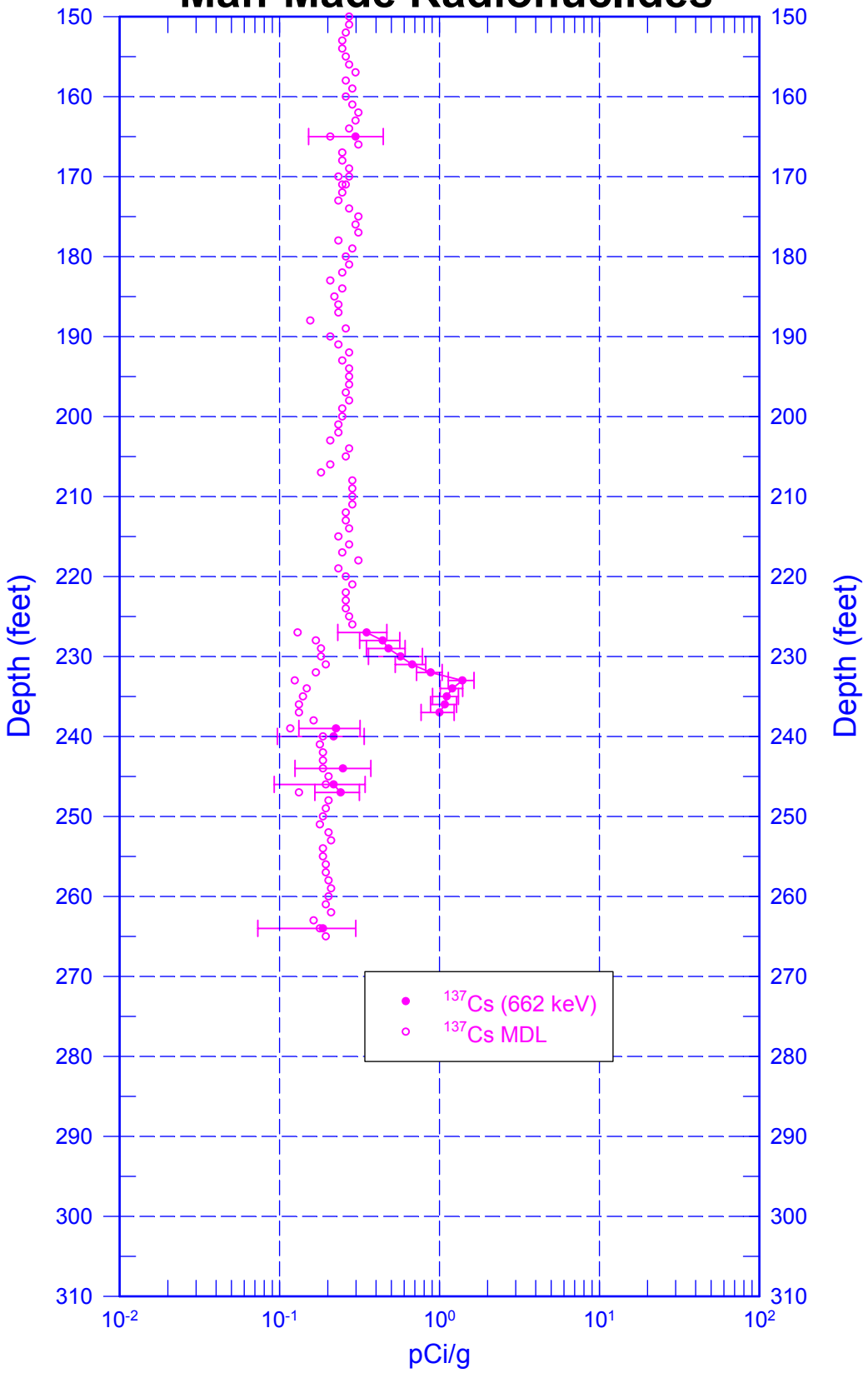
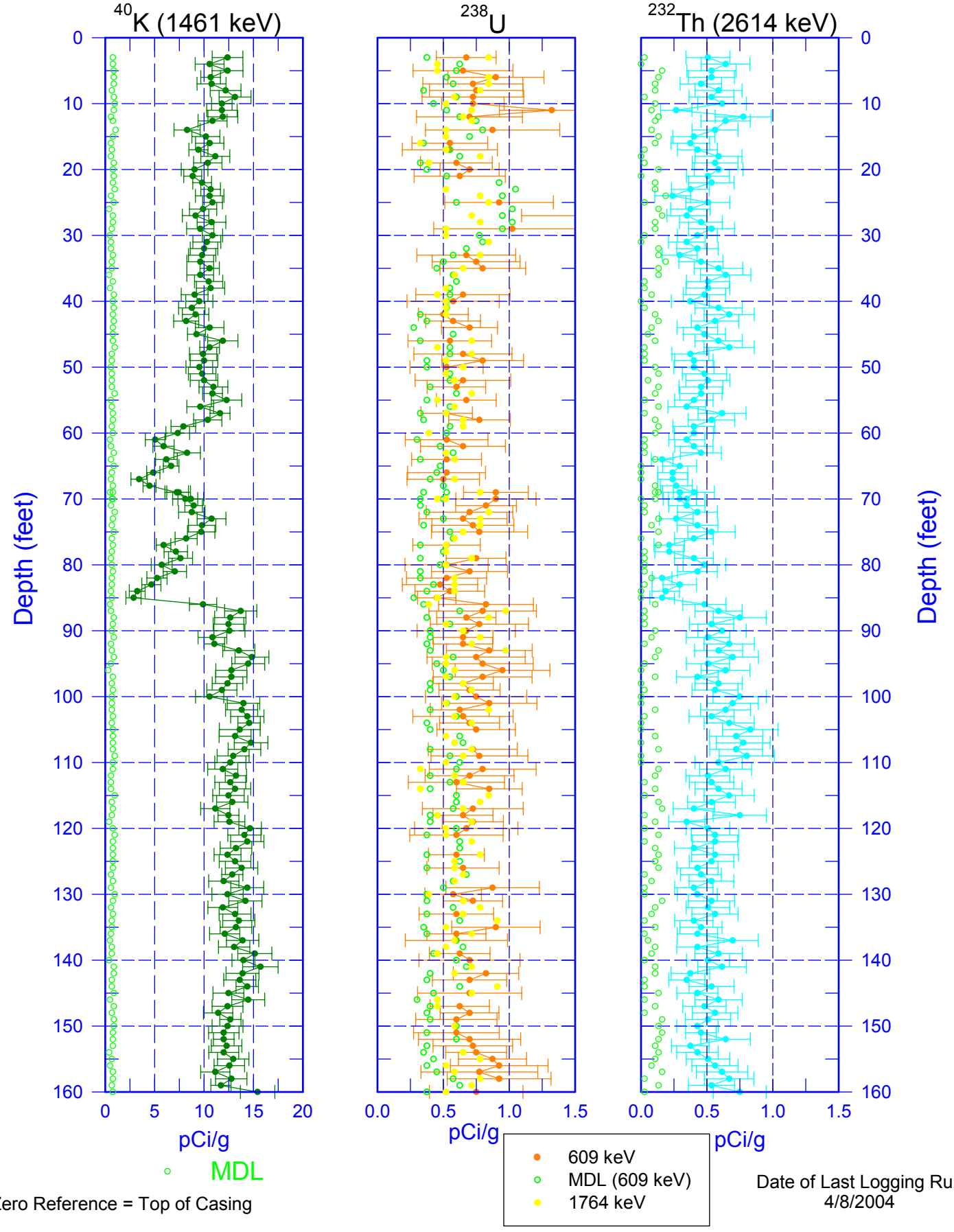
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
4/08/2004

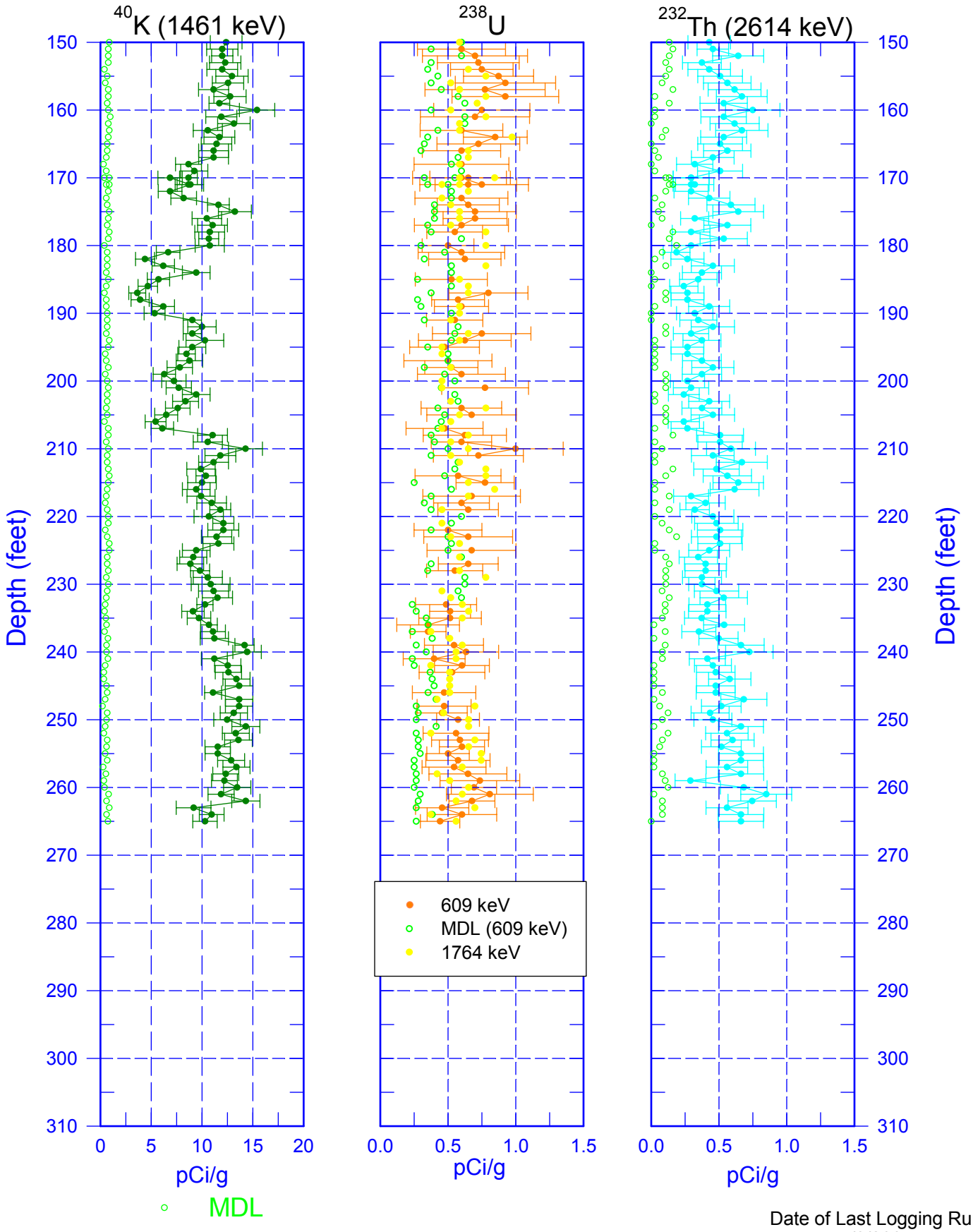
299-E25-4 (A4788)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
4/8/2004

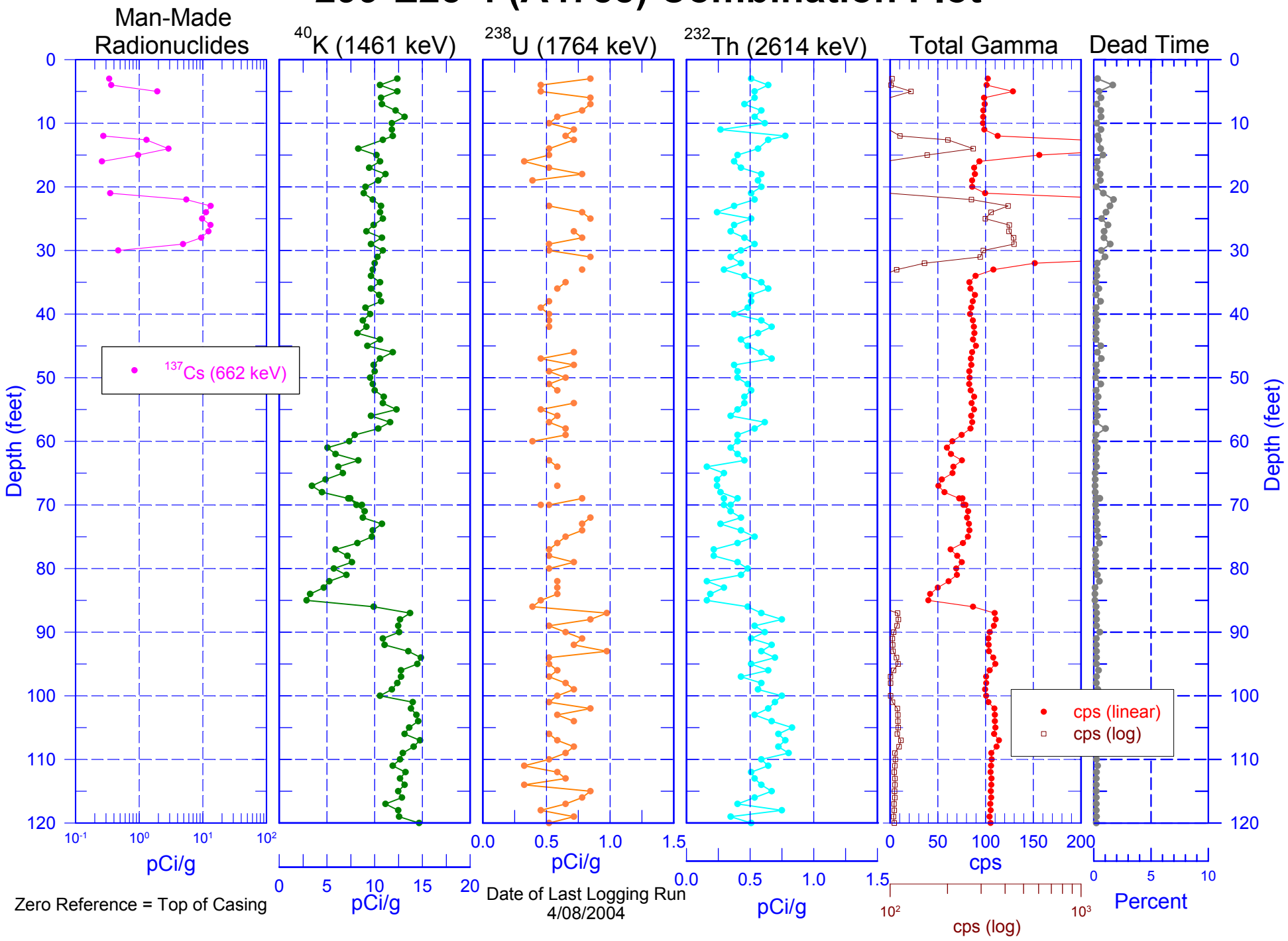
299-E25-4 (A4788)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
4/8/2004

299-E25-4 (A4788) Combination Plot



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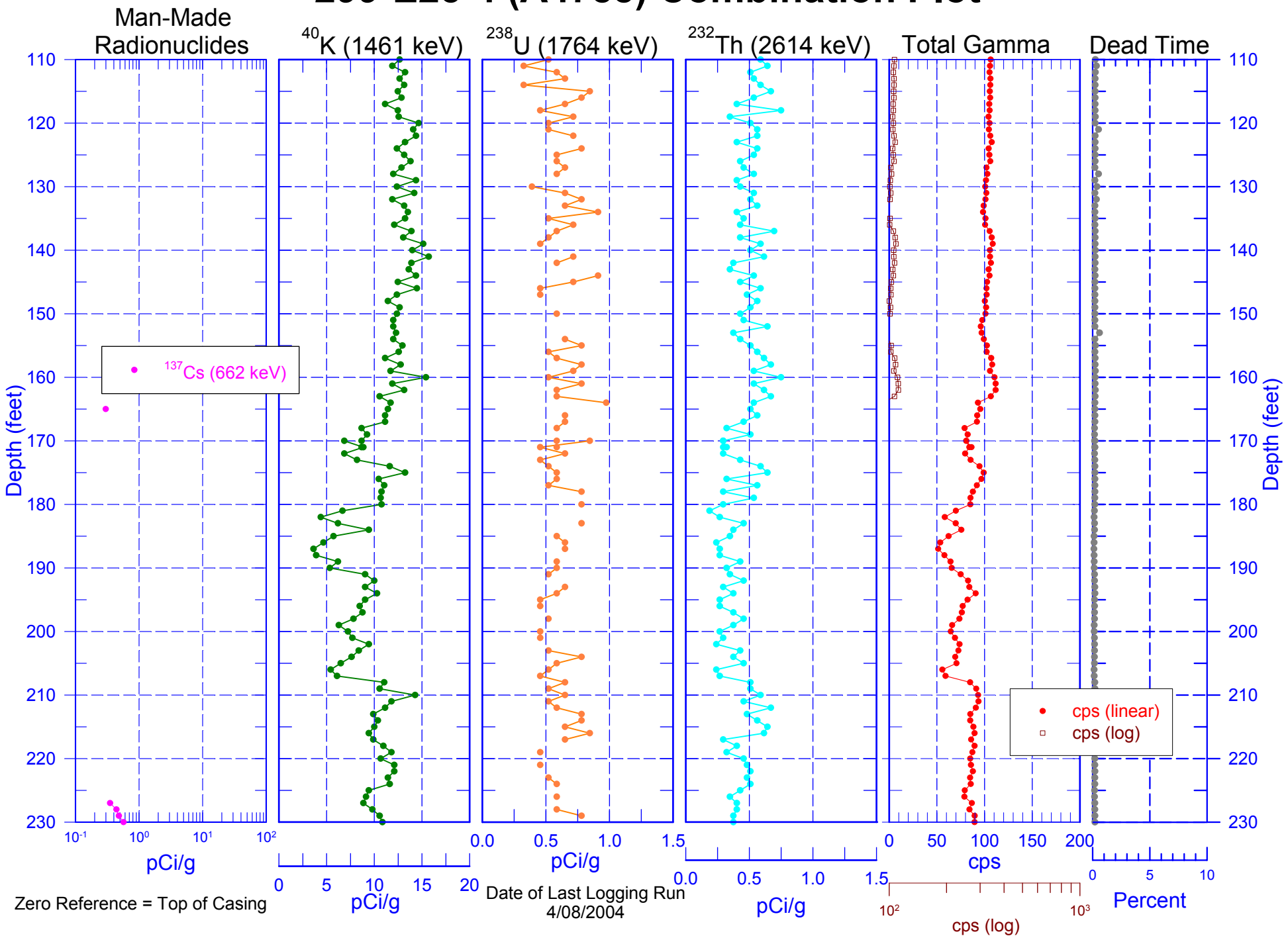
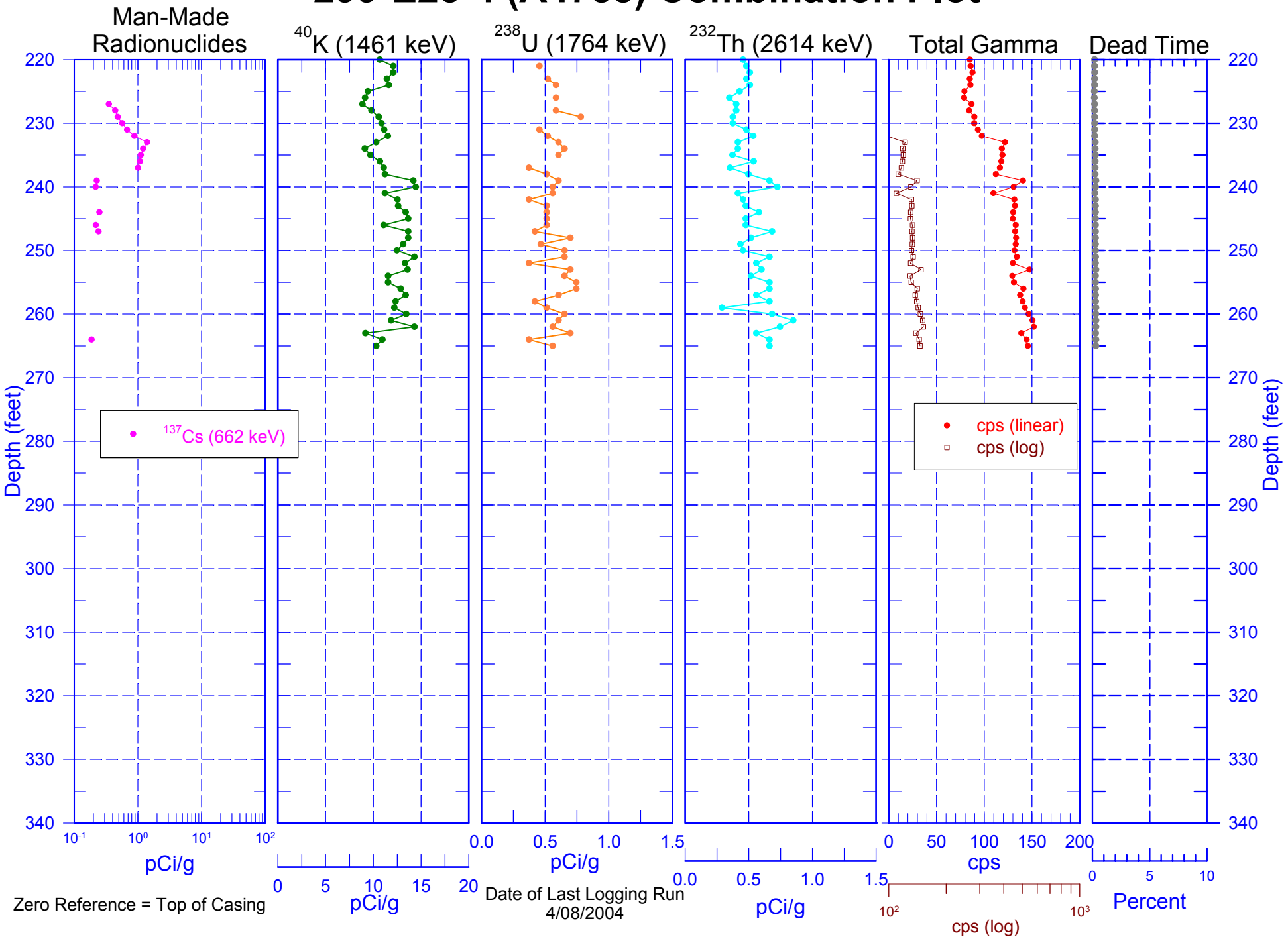
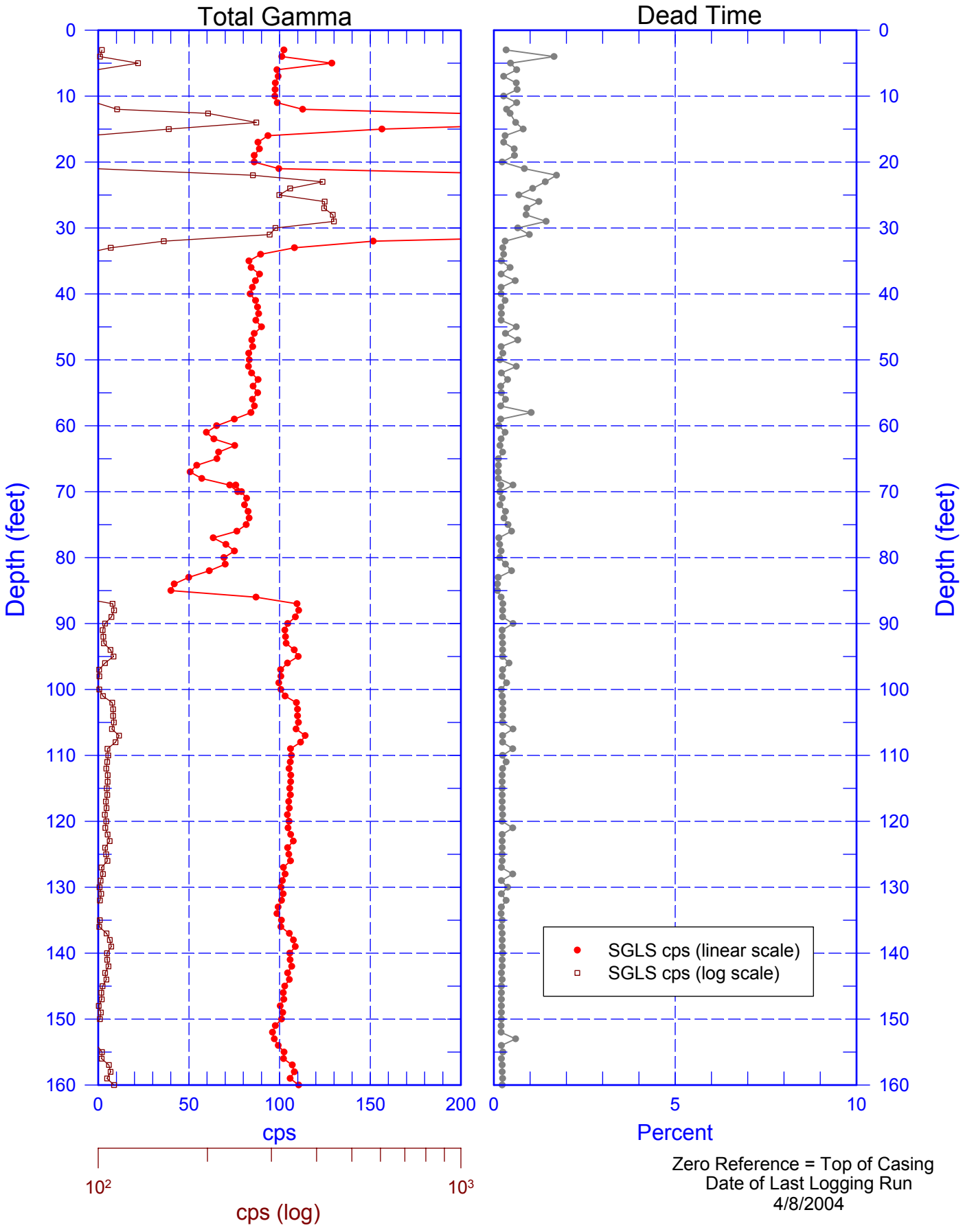


299-E25-4 (A4788) Combination Plot



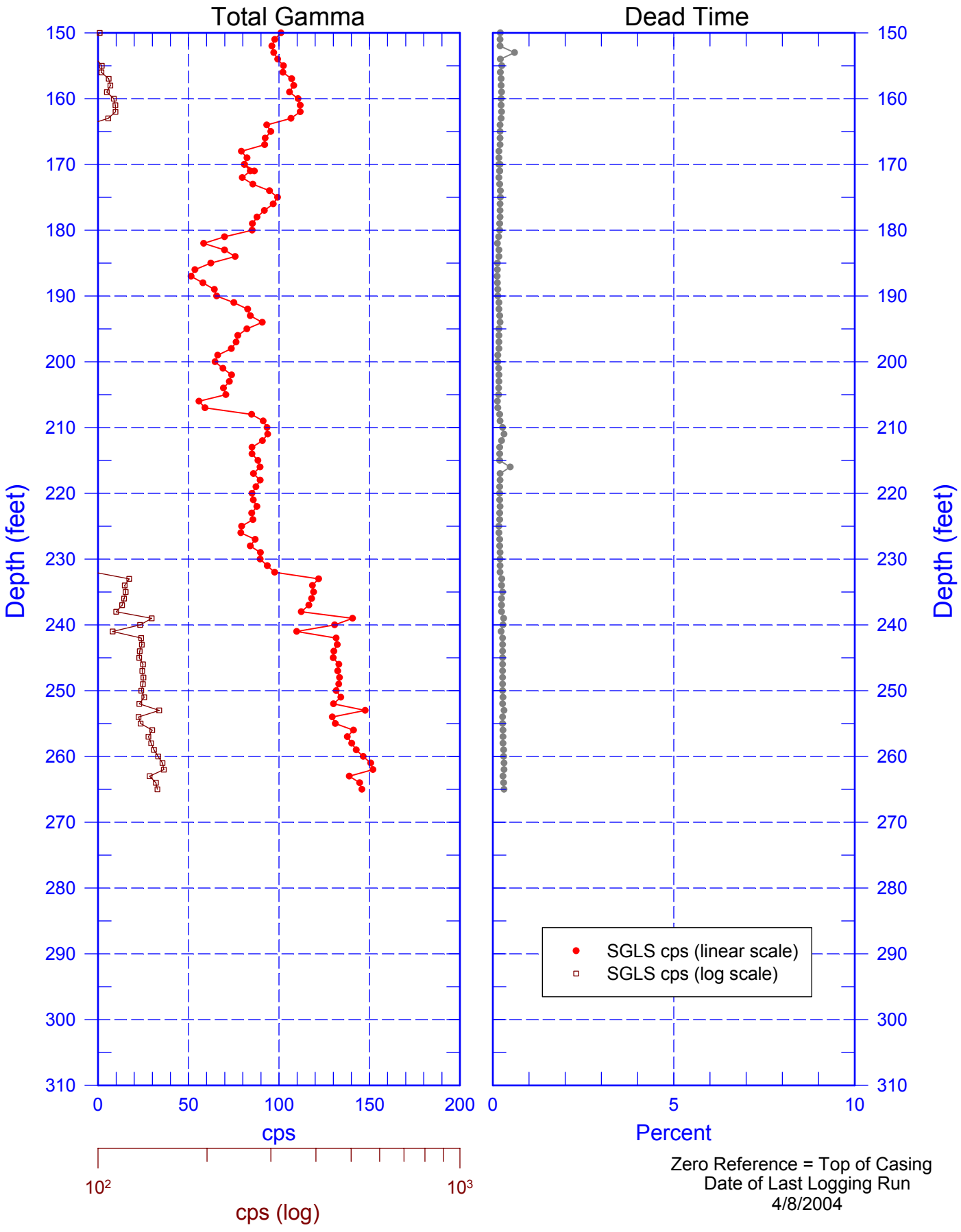
299-E25-4 (A4788)
Total Gamma & Dead Time



Zero Reference = Top of Casing
Date of Last Logging Run
4/8/2004

299-E25-4 (A4788)

Total Gamma & Dead Time



Zero Reference = Top of Casing
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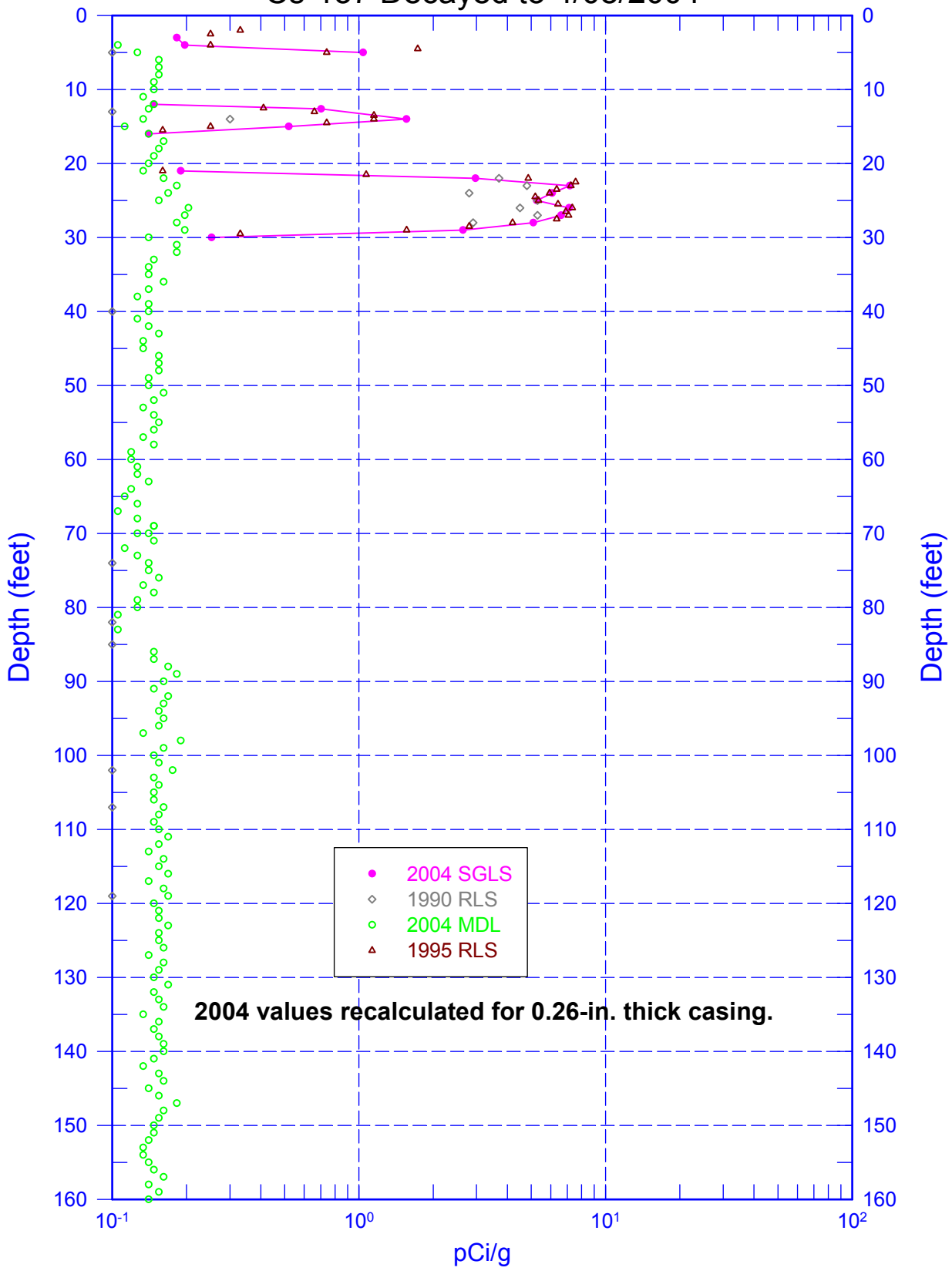
RLS Data Compared to SGLS Data

Cs-137 Decayed to 4/08/2004



Zero Reference = Top of Casing (2003 SGLS)
1990 RLS shifted down 2.0 ft to align with the SGLS

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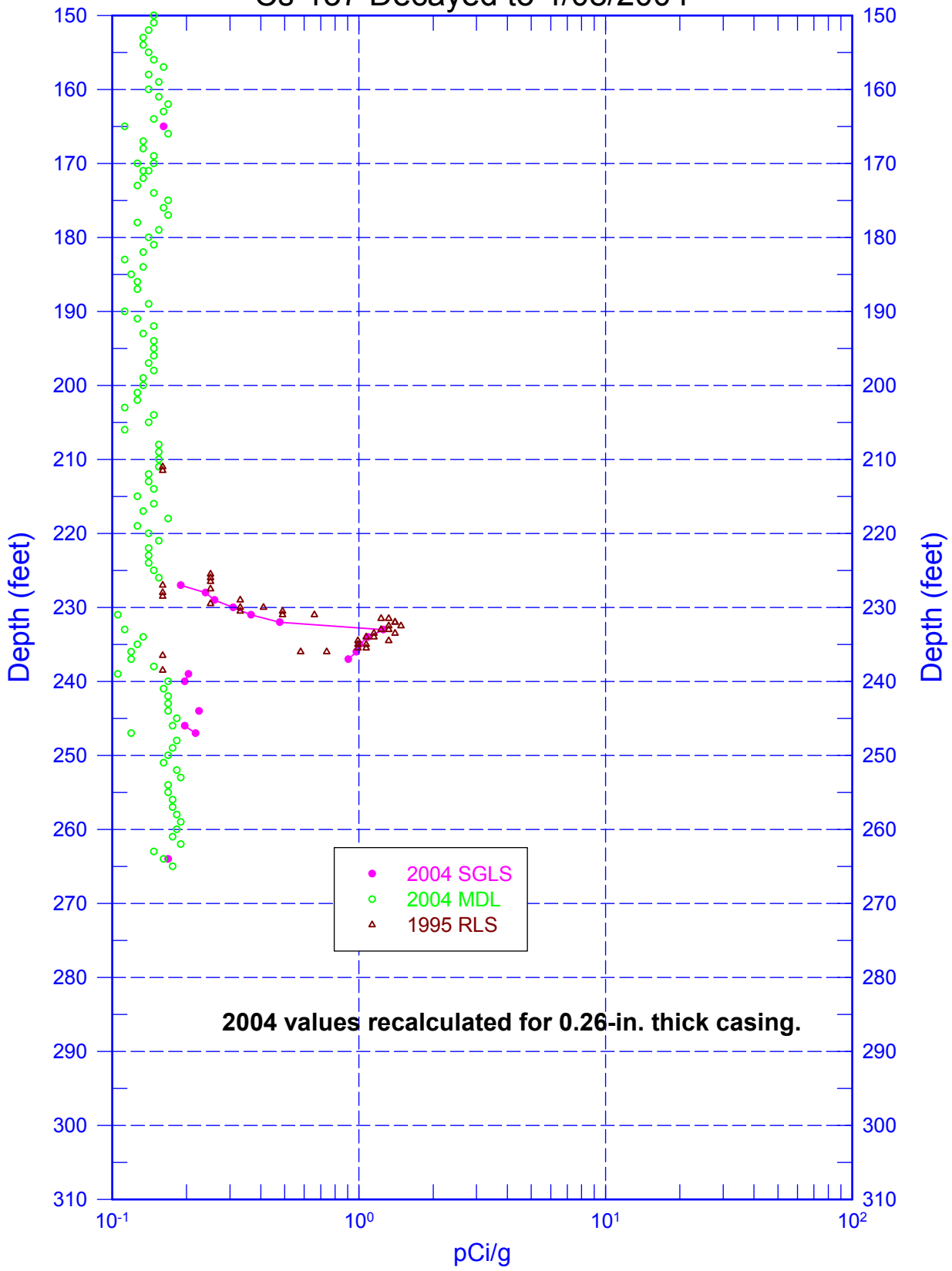
RLS Data Compared to SGLS Data

Cs-137 Decayed to 4/08/2004



Zero Reference = Top of Casing (2003 SGLS)

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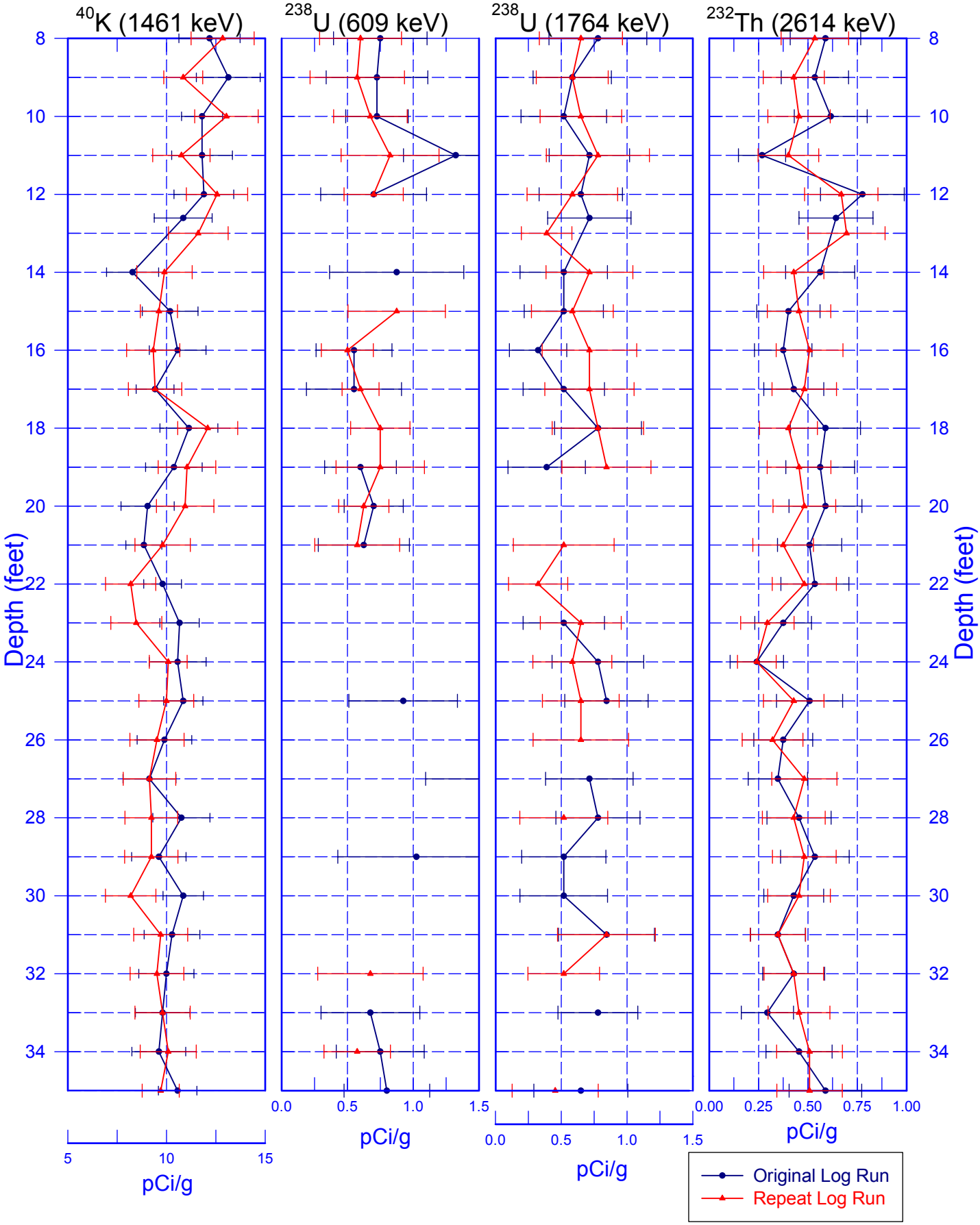
Rerun of Natural Gamma Logs (35.0 to 8.0 ft)



299-E25-4 (A4788)

Rerun of ^{137}Cs